Carbon Nanotubes
For
Next Generation X-Ray Systems

Moritz Beckmann, XinRay Systems LLC

National Nanotechnology Initiative at Ten:
NANOTECHNOLOGY INNOVATION SUMMIT

DECEMBER 8–10, 2010
GAYLORD CONVENTION CENTER
WASHINGTON, DC

XinRay Systems – the company

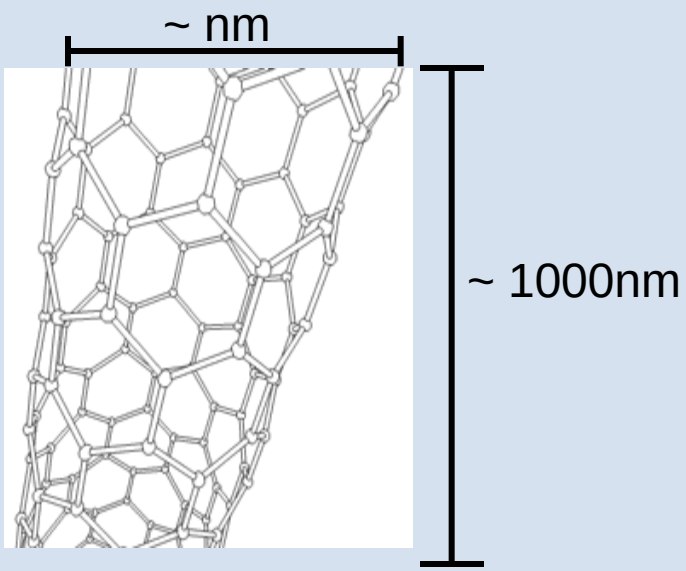
XINRAY™ systems

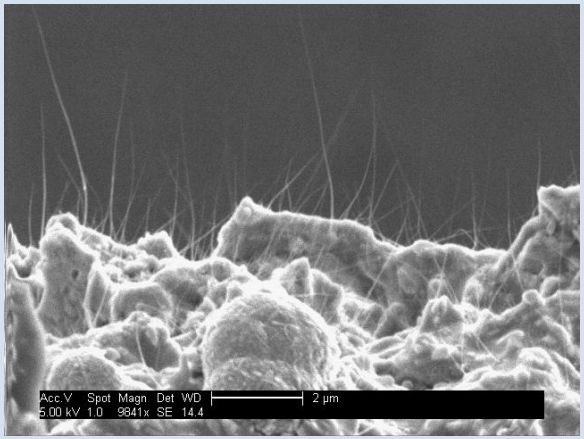
7020 Kit Creek Rd, Suite 210
Research Triangle Park
NC 27709
http://www.xinraysystems.com

- Founded in Aug 2007 as JV between Xintek and Siemens Medical Solutions
- 11 highly skilled employees
- Located in Research Triangle Park, NC

- Experts and equipment from Siemens and Xintek
- Development contracts in security and medical

Carbon Nanotubes as Field Emitters

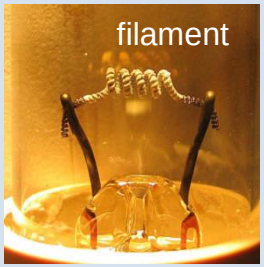


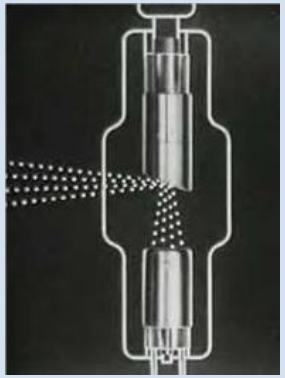


CNTs work like inverse lightning rods

XinRay Technology

Conventional technology



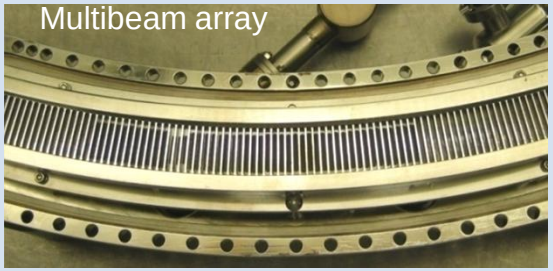


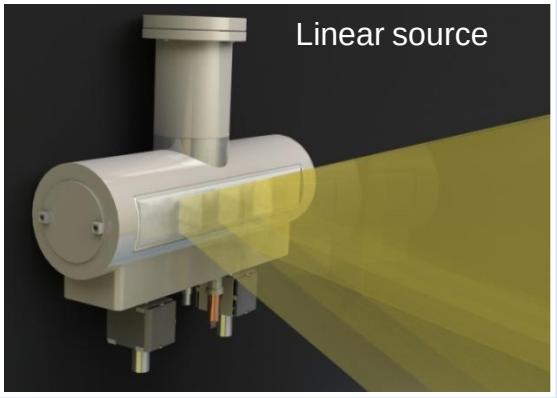
Carbon Nanotubes (CNTs)
are "cold emitters"

- Faster than thermionic emitters
- Cold → less energy required
- Can be placed close together

→ Individual emitters of multibeam array
  - can be activated in rapid sequence
  - Mimic movement
  - Multiplexing possible

XinRay x-ray tube technology



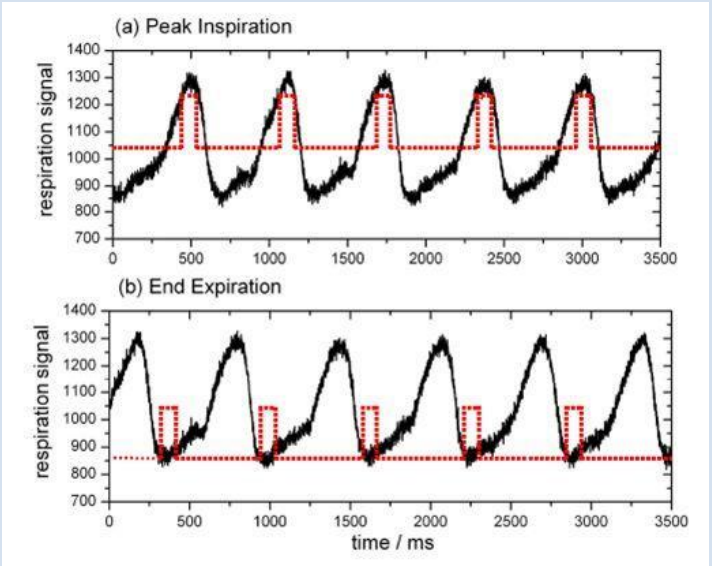


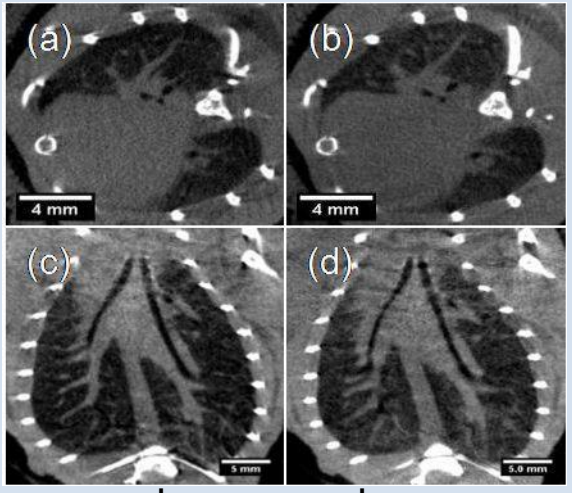
→ Enables 3D imaging systems without moving parts

Advantages –
Very fast switching – Less Dose

Preclinical applications:
- Periodic mechanical shutter
- Out of sync data is disregarded

XinRay solution:
- Extra fast switching of x-ray
- Electronically controlled exposures
- Non – periodic synchronization
- Less dose





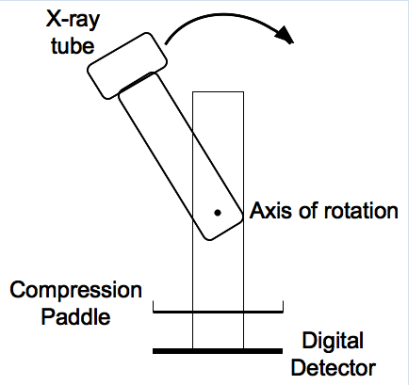
peak base

Advantages –
No mechanical movement – fast imaging

Digital Breast Tomosynthesis:

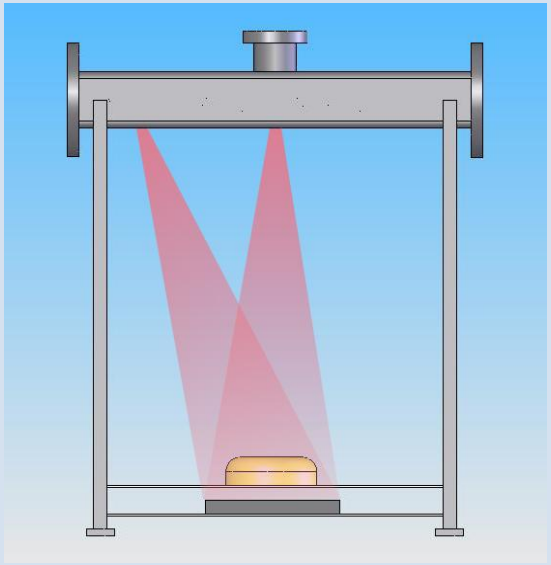
- Improved detection
- But too long exam time

  → patient discomfort and motion blur



Stationary Digital Breast Tomosynthesis:

- Faster imaging
- No motion blur



THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

NATIONAL CANCER INSTITUTE

Advantages –
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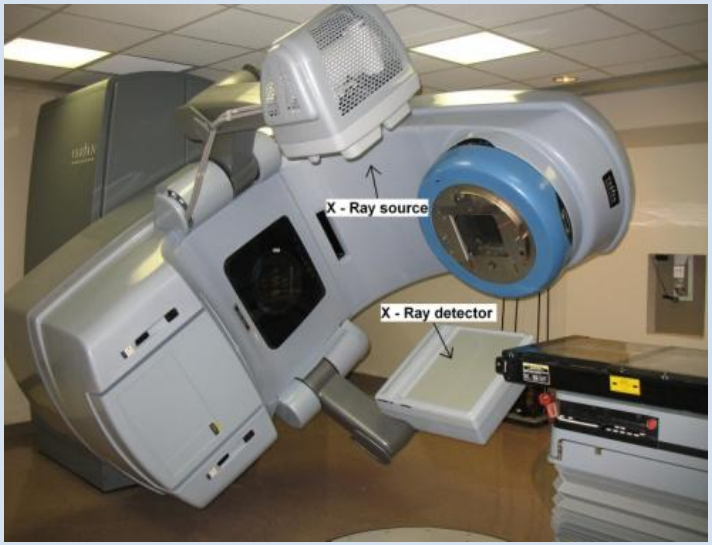
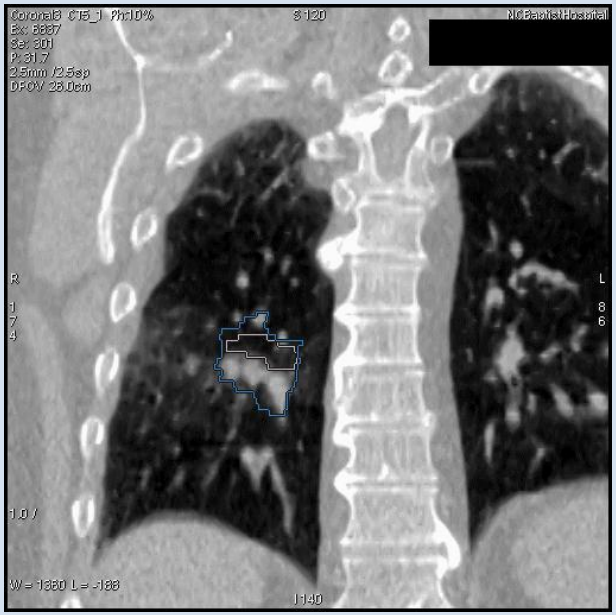
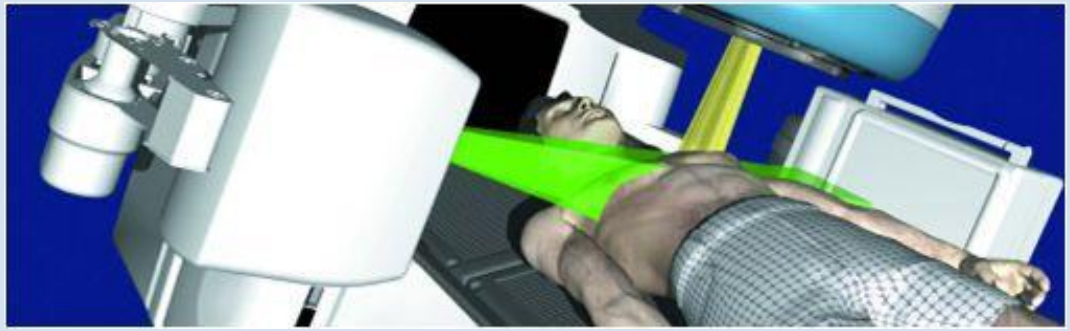
Image Guidance in Radiation Therapy:

- Irradiation of tumor from different directions
- Several sittings to treat cancer
- Planning CT, then positioning of patient relative to markers







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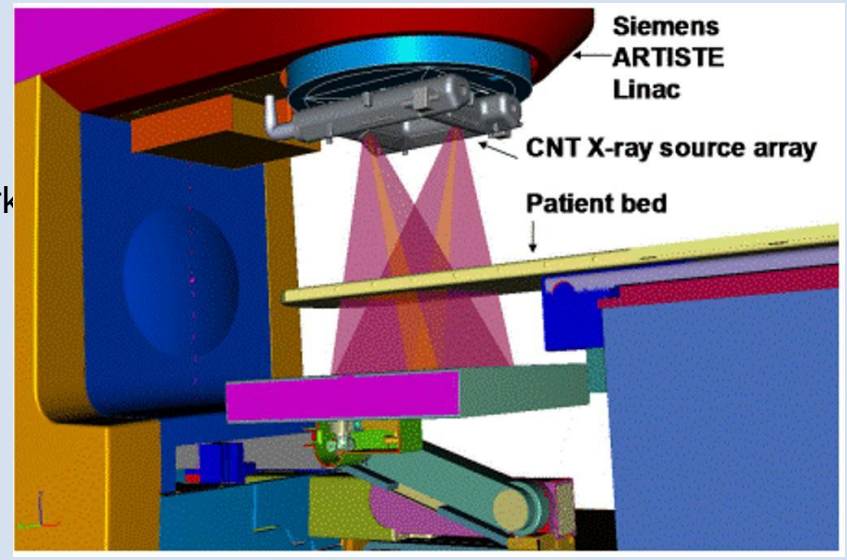
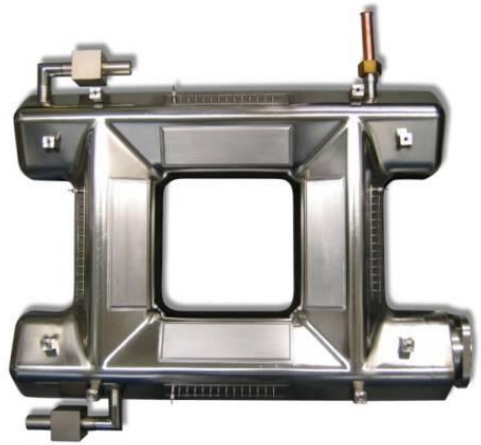
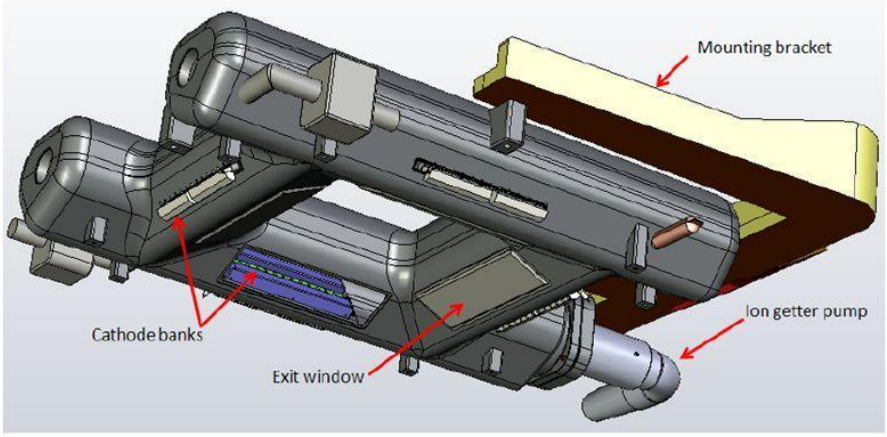


Tomosynthesis (limited angle tomography):

- Acquisition of image in a few seconds
- Imaging right before and even during treatment (interfractional imaging)
- High resolution of tumor position in plane perpendicular to treatment beam.

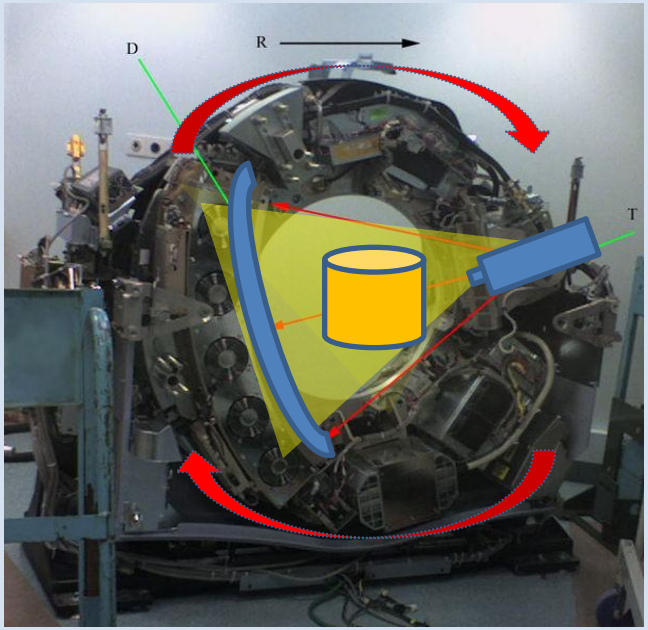




Shortcomings of conventional CT

For 40 years in 3D x-ray imaging a single source (+ detector) is moved around object to image from different directions

low resolution → insufficient detection → manual check



>85.5 million bags in 2006 (16%)

Cost of False Alarms - $ 1 billion / year

Disadvantages – conventional technology

- Limitation in speed → **limited throughput**
- Mechanical wear and tear → **high downtime and maintenance costs**
- Single x-ray source → motion blur & lower resolution → **high false alarm rate**
- System geometry dominated by circular movement → **large space requirements**

Slow - High false alarm - Bulky - High maintenance

DisAdvantages – XinRay technology

- **No** Limitation in speed → **4X throughput increase**
- **No** Mechanical wear and tear → **lower downtime and maintenance costs**
- **Better resolution → better detection** → **lower false alarm rate**
- **Geometry optimized for application** → **smaller / better detection**

This technology "will revolutionize the CT industry".

Dr. Zarur, Science Advisor, Department of Homeland Security (DHS), in Nature, July 2009

With Carbon Nanotubes XinRay offers

Faster – Smaller - Better imaging – More robust

Solutions and also enables

New Generation of Imaging Systems

Thank You !

NATIONAL NANOTECHNOLOGY INITIATIVE

COIN Center of Innovation for Nanobiotechnology

RTI INTERNATIONAL